

American Falls Subbasin Total Maximum Daily Load Plan: Subbasin Assessment and Loading Analysis



Draft



**Idaho Department of Environmental Quality
Shoshone-Bannock Tribes
U. S. Environmental Protection Agency**

July 2004

American Falls Subbasin Total Maximum
Daily Load Plan:
Subbasin Assessment and Loading Analysis

July 2004

Prepared by:

Pocatello Regional Office
Department of Environmental Quality
444 Hospital Way, #300
Pocatello, Idaho 83201

Shoshone-Bannock Tribes
P. O. Box 306
Fort Hall, Idaho 83203

Environmental Protection Agency
Region 10
1200 Sixth Avenue
Seattle, Washington 98101

Acknowledgments

The American Falls Watershed Advisory Group (WAG) provided direction in preparation of this plan. Representatives of Shoshone-Bannock Tribes, Bureau of Reclamation, Environmental Protection Agency, and Idaho Department of Environmental Quality that constitute the American Falls Subbasin Coordinating Committee also provided direction and data. Technical support services were provided to the American Falls Subbasin Coordinating Committee by the consulting firm Parsons through an EPA Region 10 contract.

Table of Contents

Acknowledgments	i
Table of Contents	ii
List of Tables	iv
List of Figures.....	vii
List of Appendices.....	viii
Abbreviations, Acronyms, and Symbols	ix
TMDL at a Glance	xiii
Executive Summary	xiii
LOADING ANALYSIS.....	XVIII
WATERBODIES RECOMMENDED FOR DELISTING	XXV
POSSIBLE ADDITIONS TO 303(D) LIST	XXVI
DATA GAPS.....	XXVI
IMPLEMENTATION STRATEGIES.....	XXVI
1. Subbasin Assessment – Watershed Characterization	1
1.1 INTRODUCTION	1
<i>Background</i>	<i>1</i>
<i>Idaho’s Role</i>	<i>2</i>
1.2 PHYSICAL AND BIOLOGICAL CHARACTERISTICS	3
<i>Geography.....</i>	<i>3</i>
<i>Climate</i>	<i>5</i>
<i>Subbasin Characteristics.....</i>	<i>5</i>
<i>Subwatershed and Stream Characteristics.....</i>	<i>12</i>
1.3 CULTURAL CHARACTERISTICS	29
<i>History.....</i>	<i>29</i>
<i>Land Use and Ownership.....</i>	<i>31</i>
<i>Cultural Features, Population, and Economics</i>	<i>31</i>
2. Subbasin Assessment – Water Quality Concerns and Status.....	43
2.1 WATER QUALITY LIMITED SEGMENTS OCCURRING IN THE SUBBASIN.....	43
2.2 APPLICABLE WATER QUALITY STANDARDS	47
<i>Beneficial Uses</i>	<i>47</i>
2.3 SUMMARY AND ANALYSIS OF EXISTING WATER QUALITY DATA.....	51
<i>Flow Characteristics, Water Column and Biological Data, Other Data, Status of Beneficial Uses,</i>	
<i>Conclusions</i>	<i>51</i>
2.4 DATA GAPS.....	96
3. Subbasin Assessment – Pollutant Source Inventory	101
3.1 SOURCES OF POLLUTANTS OF CONCERN	101
<i>Point Sources.....</i>	<i>101</i>
<i>Nonpoint Sources and Pollutant Transport.....</i>	<i>101</i>
3.2 DATA GAPS.....	105
<i>Point Sources.....</i>	<i>105</i>
<i>Nonpoint Sources.....</i>	<i>106</i>

4. Subbasin Assessment – Summary of Past and Present Pollution Control Efforts	107
5. Total Maximum Daily Loads	109
5.1 INSTREAM WATER QUALITY TARGETS	110
<i>Design Conditions/Seasonal Variation.....</i>	<i>111</i>
<i>Target Selection.....</i>	<i>112</i>
<i>Margin of Safety</i>	<i>115</i>
<i>Monitoring Points.....</i>	<i>116</i>
5.2 LOAD CAPACITY, ESTIMATES OF EXISTING POLLUTANT LOADS, LOAD ALLOCATION.....	117
<i>Models</i>	<i>118</i>
<i>Bacteria</i>	<i>122</i>
<i>Dissolved oxygen.....</i>	<i>122</i>
<i>Nutrients</i>	<i>129</i>
<i>Sediment</i>	<i>147</i>
<i>Temperature</i>	<i>149</i>
<i>Reasonable Assurance.....</i>	<i>149</i>
5.3 IMPLEMENTATION STRATEGIES	151
<i>Time Frame</i>	<i>151</i>
<i>Responsible parties.....</i>	<i>152</i>
<i>Monitoring Strategy.....</i>	<i>152</i>
5.4 CONCLUSIONS.....	153
References Cited.....	155
Glossary	165
Appendix A: State of Idaho water quality standard	191
Appendix B: Reservoir information	195
Appendix C: Snake River information.....	217
Appendix D: Point source information	227
Appendix E: Tributaries, springs, and drains information.....	235
Appendix F: Unit conversion chart	253
Appendix G: Distribution list.....	257
Appendix H: Public comments	259

List of Tables

Table ES-1. Water quality limited segments in American Falls Subbasin on the 303(d) list, including listed pollutants and beneficial uses.....	xv
Table ES-2. Load and wasteload allocations for phosphorus, nitrogen, and sediment for American Falls Subbasin waterbodies and point sources.	xix
Table 1-1. Climatological data from sites in and near American Falls Subbasin.....	7
Table 1-2. Characteristics of ecoregions in American Falls Subbasin (modified from Maret et al. 1997 and Omernik and Gallant 1986).....	8
Table 1-3. Flow into American Falls Reservoir from various tributaries based on flow measured at USGS gage sites	15
Table 1-4. Physical data, land use, and land ownership of waterbodies in American Falls Subbasin.....	16
Table 1-5. Irrigation diversions in Snake River from Bingham-Bonneville county line to American Falls Reservoir	18
Table 1-6. Mean monthly flows from April to October (general irrigation season) at USGS gage sites on Snake and Blackfoot rivers, Water Years 1964 to 2002.....	19
Table 1-7. Watershed characteristics of tributaries in the American Falls Subbasin (from DEQ BURP data).....	25
Table 1-8. Soil series in Bannock Creek watershed (from STATSGO soils database for Idaho).....	28
Table 1-9. Land use in American Falls Subbasin and Bannock Creek watershed.....	32
Table 1-10. Land ownership in American Falls Subbasin	32
Table 1-11. Population data for counties and cities in or near American Falls Subbasin (from Idaho Department of Commerce Web site)	35
Table 1-12. Employment data for Bingham, Power, and Bannock counties, 2001 (from Idaho Department of Labor Web site).....	37
Table 1-13. National Pollution Discharge Elimination System permit holders in American Falls Subbasin (from EPA Web site).....	41
Table 2-1. Water quality limited segments in American Falls Subbasin on the 303(d) list including listed pollutants and beneficial uses.....	45
Table 2-2. State of Idaho water quality numeric standards (from Idaho Department of Environmental Quality Water Quality Standards and Wastewater Treatment Requirements nda). Max = Maximum, avg. = average, and min = minimum	49
Table 2-3. Phosphorus, chlorophyll a, and nitrogen data (from BOR and DEQ sampling in American Falls Reservoir).....	55

Table 2-4. DEQ dissolved oxygen and orthophosphorus (bottom sampling) data from American Falls Reservoir, May 2001 to August 2003.....	58
Table 2-5. Indices from phytoplankton sampling by DEQ in American Falls Reservoir in 2001.....	63
Table 2-6. Indices from phytoplankton (diatoms only) sampling by DEQ in American Falls Reservoir in 2001	65
Table 2-7. Nitrogen:phosphorus ratios DEQ column sampling of American Falls Reservoir, May 2001 to August 2003	69
Table 2-8. Descriptive statistics from USGS and DEQ sampling data on Snake River at four bridge sites, April 2000 to July 2003.....	77
Table 2-9. USGS bedload sampling at Snake River near Shelley gage site (13060000), 2000 to 2002	78
Table 2-10. Stormwater runoff data from sampling by City of Blackfoot and DEQ for two discharges to the snake River, June 2001 and March 2002.	78
Table 2-11. USGS Snake River temperature monitoring data.....	79
Table 2-12. Temperature exceedances of state water quality standards in Snake River (from USGS temperature monitoring data)	79
Table 2-13. Descriptive statistics from BOR sampling of American Falls Reservoir tributaries, springs, and drains.....	89
Table 2-14. BURP data analysis and waterbody assessment of American Falls Subbasin tributaries.....	91
Table 2-15. Shoshone-Bannock Tribes nutrient sampling results from Bannock Creek watershed	92
Table 2-16. BOR flow data from McTucker Creek near ponds.....	93
Table 2-17. Descriptive statistics from streams, canals, and wetlands on north and west sides of American Falls Reservoir, 1997 to 2002.....	95
Table 2-18. Water quality data from wastewater treatment plants in American Falls Subbasin, January 2000 to September 2003 (from Discharge Monitoring Reports)	97
Table 3-1. Waterfowl nutrient loading in American Falls Reservoir. It was assumed that nutrients were ingested off reservoir and deposited on reservoir	105
Table 5-1. American Falls Reservoir model data gaps	121
Table 5-2. Bannock Creek watershed modeling input variables and outputs	127
Table 5-3. TMDL target concentrations for total phosphorus based on average flow.....	128
Table 5-4. American Falls Reservoir model results for three TMDL scenarios	129
Table 5-5. Load analyses for American Falls Subbasin waterbodies	133
Table 5-6. Wasteload analyses for point source dischargers in American Falls Subbasin	137

Table 5-7. Load analyses for City of Blackfoot stormwater runoff. Estimated loads based on simple method model	139
Table 5-8. Wasteload allocations for total phosphorus and total nitrogen based on change in facilities management plans and growth (2% per year) for wastewater treatment plants (WWTP) in American Falls Subbasin.....	141
Table 5-9. Bannock Creek annual average nitrogen and phosphorus load capacities.....	141
Table 5-10. Bannock Creek nitrogen and phosphorus annual average concentrations and percent reduction required.....	141
Table 5-11. Bannock Creek nitrogen and phosphorus annual average loading and percent reduction required.....	141
Table 5-12. City of Pocatello sampling on Portneuf River at Siphon Road, February 1999-August 2003.....	145
Table 5-13. Load analysis for Portneuf River.....	146
Table 5-14. Crystal Springs Trout Farm data, from Best Management Practices Plan --Crystal Springs Trout Farm OD-G13-0038.	147
Table 5-15. Bannock Creek, West Fork, Moonshine Creek, and Rattlesnake Creek annual sediment load capacities.....	148
Table 5-16. Existing annual average sediment loads from nonpoint sources in Bannock Creek, West Fork, Moonshine Creek, and Rattlesnake Creek.....	148
Table 5-17. Bannock Creek, West Fork, Moonshine Creek, and Rattlesnake Creek sediment load allocations.	148

List of Figures

Figure 1-1. American Falls Subbasin (from Idaho Department Of Environmental Quality Data Sets)	4
Figure 1-2. Soil Slope in American Falls Subbasin (from Idaho Department Of Environmental Quality GIS Data Sets)	10
Figure 1-3. Soil Erosion Capability in American Falls Subbasin (from Idaho Department Of Environmental Quality GIS Data Sets). Soil Erosion Capability Increases as K-Factor increases	11
Figure 1-4. Mean monthly flows at USGS surface-water stations in the Snake River at Neeley (13077000) before and after construction of American Falls Dam and near Blackfoot (13069500) before and after construction of Island Park Dam	13
Figure 1-5. Storage capacity in American Falls Reservoir (from Bureau of Reclamation Web site c)	14
Figure 1-6. 303(d) listed Waterbodies in American Falls Subbasin (from Idaho Department Of Environmental Quality Data Sets)	22
Figure 1-7. Bannock Creek Watershed	23
Figure 1-8. Land Use in American Falls Subbasin (from Idaho Department Of Water Resources GIS Data Sets)	33
Figure 1-9. Land Ownership in American Falls Subbasin (from Idaho Department Of Environmental Quality GIS Data Sets)	34
Figure 2-1. DEQ Sample Sites on American Falls Reservoir. Sites were located on the pictured transects close to the Western Shore	57
Figure 2-2. Phosphorus, nitrogen, and chlorophyll <i>a</i> levels at three sites in American Falls Reservoir, 2001..	60
Figure 2-3. Phosphorus, nitrogen, and chlorophyll <i>a</i> levels at three sites in American Falls Reservoir, 2002..	61
Figure 2-4. Phosphorus, nitrogen, and chlorophyll <i>a</i> levels at three sites in American Falls Reservoir, 2003..	62
Figure 2-5. Annual (calendar year) average flow in the Snake River at Neeley (13077000) and near Blackfoot (13069500) USGS surface-water stations	73
Figure 2-6. DEQ continuous (15-minute interval) monitoring data from Snake River, August, September 2002	83
Figure 2-7. Average monthly flow at Bannock Creek USGS surface-water station (13076200), June 1985 to September 1994	87
Figure 5-1. Bannock Creek Watershed land use	125
Figure 5-2. Bannock Creek Watershed soil	126

List of Appendices

Appendix A: State of Idaho water quality standard191

Appendix B: Reservoir information195

Appendix C: Snake River information.....217

Appendix D: Point source information227

Appendix E: Tributaries, springs, and drains information.....235

Appendix F: Unit conversion chart253

Appendix G: Distribution list.....257

Appendix H: Public comments259

Abbreviations, Acronyms, and Symbols

303(d), §303(d)	Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired waterbodies required by this section	cfs	cubic foot (feet) per second
u(μ)	micro, one-one millionth	chl <i>a</i>	chlorophyll <i>a</i>
uS/cm	microSiemens/centimeter	cm	centimeter(s)
§	Section (usually a section of federal or state rules or statutes)	CWA	Clean Water Act
ac-ft	acre foot (feet)	CWAL	coldwater aquatic life
ADB	assessment database	CWE	cumulative watershed effects
avg	average	DEQ	Idaho Department of Environmental Quality
AWS	agricultural water supply	DO	dissolved oxygen
BAG	Basin Advisory Group	DOI	U.S. Department of the Interior
BLM	United States Bureau of Land Management	DWS	domestic water supply
BMP	best management practice	EC	electro conductivity
BOD	biochemical oxygen demand	EMAP	Environmental Monitoring and Assessment Program
BOR	United States Bureau of Reclamation	EPA	United States Environmental Protection Agency
Btu	British thermal unit	ESA	Endangered Species Act
BURP	Beneficial Use Reconnaissance Program	F	Fahrenheit
C	Celsius	FPA	Idaho Forest Practices Act
CFR	Code of Federal Regulations (refers to citations in the federal administrative rules)	FWS	U.S. Fish and Wildlife Service
		GIS	Geographical Information Systems
		HCO₃	bicarbonate
		HUC	Hydrologic Unit Code

I.C.	Idaho Code	mi²	square miles
IDAPA	Refers to citations of Idaho administrative rules	min	minimum
IDFG	Idaho Department of Fish and Game	mm	millimeter
IDL	Idaho Department of Lands	MOS	margin of safety
IDWR	Idaho Department of Water Resources	MRCL	multiresolution land cover
in	inch	MWMT	maximum weekly maximum temperature
INFISH	The federal Inland Native Fish Strategy	N	nitrogen
IRIS	Integrated Risk Information System	n.a.	not applicable
km	kilometer	NA	not assessed
km²	square kilometer	NB	natural background
L	liter	nd	no data (data not available)
LA	load allocation	nda	no date available
LC	load capacity	NFS	not fully supporting
m	meter	NH₃	ammonium
m³	cubic meter	NO₂	nitrite
max	maximum	NO₃	nitrate
MBI	macroinvertebrate index	NPDES	National Pollutant Discharge Elimination System
mg	milligram	nr	near
MGD	million gallons per day	NRCS	Natural Resources Conservation Service
mg/L	milligrams per liter	NTU	nephelometric turbidity unit
mi	mile	ORV	off-road vehicle
		ORW	Outstanding Resource Water

P	phosphorus	SS	suspended sediment
PACFISH	The federal Pacific Anadromous Fish Strategy	SSC	suspended sediment concentration
PCR	primary contact recreation	SSOC	stream segment of concern
PFC	proper functioning condition	STATSGO	State Soil Geographic Database
PO₄	phosphate	SU	standard units
ppm	part(s) per million	TDG	total dissolved gas
QA	quality assurance	TDS	total dissolved solids
QC	quality control	T&E	threatened and/or endangered species
RBP	rapid bioassessment protocol	TIN	total inorganic nitrogen
RDI	DEQ's river diatom index	TKN	total Kjeldahl nitrogen
RFI	DEQ's river fish index	TMDL	total maximum daily load
RHCA	riparian habitat conservation area	TP	total phosphorus
RMI	DEQ's river macroinvertebrate index	TS	total solids
RPI	DEQ's river physiochemical index	TSS	total suspended solids
SaSp	salmonid spawning	t/y	tons per year
SBA	subbasin assessment	U.S.	United States
SCR	secondary contact recreation	U.S.C.	United States Code
SFI	DEQ's stream fish index	USDA	United States Department of Agriculture
SHI	DEQ's stream habitat index	USDI	United States Department of the Interior
SMI	DEQ's stream macroinvertebrate index	USFS	United States Forest Service
SRP	soluble reactive phosphorus	USGS	United States Geological Survey

WAG Watershed Advisory Group

WBAG *Waterbody Assessment Guidance*

WBID waterbody identification number

WET whole effluence toxicity

WLA wasteload allocation

WQLS water quality limited segment

WQMP water quality management plan

WQRP water quality restoration plan

WQS water quality standard

WY water year (October to September)

TMDL at a Glance

<i>Subbasin:</i>	<i>American Falls</i>
<i>HUC:</i>	<i>17040206</i>
<i>Key Resources:</i>	<i>Coldwater Aquatic Life, Salmonid Spawning, Primary/Secondary Contact Recreation, Domestic & Agricultural Water Supply, Aesthetics, Wildlife Habitat</i>
<i>Uses Affected:</i>	<i>Coldwater Aquatic Life, Salmonid Spawning, Primary/Secondary Contact Recreation, Domestic Water Supply, Aesthetics</i>
<i>Pollutants:</i>	<i>Sediment, Nutrients, Bacteria, Dissolved Oxygen, Flow Alteration, Unknown</i>
<i>Sources Considered:</i>	<i><u>PS</u> – wastewater treatment plants, fish hatcheries, stormwater <u>NPS</u> - agriculture, grazing, roads, urban</i>



Executive Summary

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. States and tribes, pursuant to Section 303 of the CWA are to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize waterbodies that are water quality limited (i.e., waterbodies that do not meet water quality standards). States and tribes must periodically publish a priority list of impaired waters, currently every four years. For waters identified on this list, states and tribes must develop a total maximum daily load (TMDL) for the pollutants, set at a level to achieve water quality standards. This document addresses the waterbodies in American Falls Subbasin that have been placed on what is known as the "303(d) list."

This subbasin assessment and TMDL analysis has been developed to comply with Idaho's TMDL schedule. This assessment describes the physical, biological, and cultural setting; water quality status; pollutant sources; and recent pollution control actions in the American Falls Subbasin located in southeast Idaho. The first part of this document, the subbasin assessment, is an important first step in leading to the TMDL. The starting point for this assessment was Idaho's current 303(d) list of water quality limited waterbodies. Ten segments of the American Falls Subbasin were listed on this list. The subbasin assessment portion of this document examines the current status of 303(d)-listed waters, and defines the extent of impairment and causes of water quality limitation throughout the subbasin. The loading analysis quantifies pollutant sources and allocates responsibility for load reductions needed to return listed waters to a condition of meeting water quality standards.

American Falls Subbasin covers 2,869 square miles (1.8 million acres, 0.75 million hectares) in southeast Idaho. Urban areas within or adjacent to the subbasin are American Falls, Aberdeen, Blackfoot, Firth, and Shelley. Much of the subbasin lies within the Fort Hall Indian Reservation. Major land uses include dryland and irrigated agriculture, and livestock grazing. American Falls Reservoir is the predominant waterbody in the subbasin and provides both irrigation water and electricity. Major subbasin tributaries to the reservoir include Snake River from the reservoir to Bingham-Bonneville county line, Spring Creek, McTucker Creek, Danielson Creek, Bannock Creek, and Ross Fork.

Historically, American Falls Subbasin waterbodies sustained several beneficial uses (Table ES-1). All streams supported coldwater aquatic life, agriculture and industrial water supply, aesthetics, and wildlife habitat as well as secondary contact recreation with the bigger streams also supporting primary contact recreation. Most streams also maintained spawning populations of salmonids. Domestic water supply has been officially declared a designated use in Snake River and American Falls Reservoir. Current information suggests that some beneficial uses, such as coldwater aquatic life and salmonid spawning, are impaired and are not fully supported in several waterbodies in the subbasins.

There are ten water quality segments listed on the 1998 303(d) list (Table ES-1). In addition to American Falls Reservoir, three streams, which flow into the reservoir, are on the list – Snake River, McTucker Creek, and Bannock Creek. The remaining listed waterbodies are tributaries of Bannock Creek and include Moonshine Creek, Rattlesnake Creek, West Fork Bannock Creek, and Knox Creek.

The current list of water quality limited waterbodies includes streams from previous lists and those added to the 1998 list. All streams listed prior to 1998 had sediment, nutrients, or both listed as a pollutant of concern (Table ES-1). Dissolved oxygen and flow alteration were identified as problems in American Falls Reservoir and Snake River. Bannock Creek was also on the list for bacteria concerns. For Knox Creek, which was added to the list in 1998, pollutants of concern were listed as unknown. Key beneficial uses affected by these pollutants are coldwater aquatic life, salmonid spawning, and contact recreation.

Several sources of pollutants have been identified in American Falls Subbasin. Agriculture has been positively related to both nutrient and sediment loading. Stormwater runoff is also a source of both sediments and nutrients. Other likely contributors to sediment loading in subbasin streams are livestock practices; stream channels and banks; and roads. Windblown sediment and shoreline erosion add to sediment loading in American Falls Reservoir. In addition to agriculture and stormwater, wastewater treatment plants are a source of nutrients in the subbasin. Waterfowl add to nutrient loading, primarily in the reservoir. Another source of phosphorus in the reservoir is bottom sediments, which add to overall phosphorus loading through internal recycling. Other possible contributors of nutrients include livestock grazing, recreation, and failed septic systems.

Table ES-1. Water quality limited segments in American Falls Subbasin on the 303(d) list including listed pollutants and beneficial uses.

Waterbody	Water quality limited segment boundary		Listed pollutants ¹	Beneficial uses ²				
	Lower	Upper		Cold water aquatic life	Salmonid spawning	Contact recreation Primary	Secondary	Domestic water
American Falls Reservoir			DO, Flow Alt, Nut, Sed	D		D	P	D
Snake River	American Falls Reservoir	Ferry Butte	Sed	D	D	D	P	D
	Ferry Butte	Bingham-Bonneville county line	DO, Flow Alt, Nut, Sed	D	D	D	P	D
McTucker Creek	Snake River	Headwaters	Sed	P			P	
Bannock Creek	American Falls Reservoir	Reservation boundary	Bact, Nut, Sed	D	E		D	
	Reservation boundary	Headwaters	Bact, Nut, Sed	D	E		D	
Moonshine Creek	Reservation boundary	Headwaters	Sed	P			P	
Rattlesnake Creek	Reservation boundary	Headwaters	Sed	P			P	
West Fork Bannock Creek	Reservation boundary	Headwaters	Sed	P			P	
Knox Creek	Bannock Creek	Headwaters	Unknown	P			P	

¹DO=dissolved oxygen, Flow Alt=flow alteration, Nut=nutrients, Sed=sediment, Bact=bacteria

²D=designated in State Water Quality Standards, P=use not designated so presumed to support use, E=existing use; all waterbodies are considered to support agriculture and industrial water supply, wildlife habitat, and aesthetics; beneficial use information from the Idaho Water Quality Standards and Wastewater Treatment Requirement and Beneficial Use Reconnaissance Program monitoring

This Page Intentionally Left Blank.

From a geographical perspective, a major contributor of both nutrients and sediment to American Falls Reservoir is an out-of-subbasin tributary, Portneuf River.

There are thirteen NPDES dischargers within American Falls Subbasin. Four are wastewater treatment plants at Aberdeen, Blackfoot, Firth, and Shelley. Four permits relate to fish hatcheries with Crystal Springs holding three permits and Indian Springs holding one permit. The other five NPDES permits relate to large confined animal feeding operations – Snake River Cattle Company, Tom Anderson Cattle Company, Bragg feedlot, Kerry Ward feedlot, and Alan Andersen dairy.

Load allocations (quantity of pollutants a stream can assimilate without impairing beneficial uses) were based on target concentrations chosen such that attainment of the target would result in meeting beneficial uses. Although phosphorus is most likely the limiting nutrient in American Falls Reservoir, targets were recommended for both phosphorus and nitrogen. The targets for total phosphorus and total nitrogen were set at 0.05 and 0.85 mg/L, respectively, for tributaries to the reservoir and point sources. A total inorganic nitrogen, rather than total nitrogen, target was established in Portneuf River for consistency with prior load allocation recommendations. No load allocations were placed on the reservoir although an average chlorophyll a concentration for July and August not to exceed 0.015 mg/L was suggested. An average concentration not to exceed 60 mg/L of suspended sediment over a 14-day period was recommended for waterbodies in American Falls Subbasin listed for sediment problems, except for Bannock Creek watershed. For Bannock Creek and tributaries, a surrogate sediment target of 80% streambank stability was used to develop load allocations.

Load allocations were not established for flow alteration, dissolved oxygen (DO), or bacteria. For flow alteration, it is not considered a pollutant, and TMDLs need to be written only for pollutants. Data did not indicate dissolved oxygen was a problem in Snake River, and it was assumed that control of nutrients and subsequent reduction in algal densities will lead to observance of water quality standards for dissolved oxygen in the reservoir. Data were insufficient to conclude contact recreation impairment by bacteria in Bannock Creek, so a plan was recommended to collect necessary data to determine beneficial use support.

TMDLs must also include a margin of safety and consider seasonality in the analysis. In TMDLs for American Falls Subbasin, the choice of conservative targets results in an inherent margin of safety when estimating load and wasteload allocations. Seasonality was only considered in the establishment of the chlorophyll a target for the reservoir, which is based on a July and August average. It is during these months that recreational use is high as is the potential for growth of aquatic vegetation.

The amount and periodicity of data varied by waterbody. Load allocations were thus based on available data. Most of the data used to calculate loads were collected since 2000 and generally reflect drought conditions in southeast Idaho. Discharge Monitoring Reports (DMRs) provided the basis for estimating wasteloads for NPDES permit holders.

Loading Analysis

A quick overview of both listed and unlisted waterbodies, and point sources, for which load and wasteload allocations were recommended is as follows:

American Falls Reservoir – This waterbody is listed for flow alteration, DO, nutrients, and sediment (Table ES-1). As mentioned, no TMDLs were prepared for waterbodies affected by flow alteration. No data were reviewed to indicate sediment was impairing beneficial uses in the reservoir, so no TMDL was done. The reservoir has a history of algae problems exacerbated by nutrient loading to the reservoir. The primary beneficial use affected is coldwater aquatic life. Sources of nutrients into the reservoir include: tributaries, springs, and drains; waterfowl; and internal recycling of phosphorus. A goal of an average (July and August) concentration not to exceed 0.015 mg/L of chlorophyll *a* was set for the reservoir with the assumption that attainment of this target will lead to observance of water quality standards for dissolved oxygen and support of coldwater aquatic life beneficial use. A rudimentary model was employed to examine effects of suggested reductions in phosphorus loading to the reservoir. The model predicts that with recommended phosphorus load allocations average concentration of chlorophyll *a* will meet the target concentration of 0.015 mg/L and DO water quality standards will be supported, except in the highest of water years. This reservoir should be scheduled for future Beneficial Use Reconnaissance Program (BURP) monitoring to determine support of beneficial uses.

Snake River – American Falls Reservoir to Ferry Butte – This water quality limited segment is listed for sediment (Table ES-1). No data were reviewed to suggest sediment is impairing beneficial uses in this reach; however, the effect of bedload and water column sediment in average to high water years is unknown. Until such data are collected, or BURP assessment indicates beneficial use support, it is assumed that sediment is impairing beneficial uses in the reach. Beneficial uses possibly affected are coldwater aquatic life and salmonid spawning. Eroding streambanks are a source of sediment in this reach. Other possible sediment sources are agriculture, livestock grazing, and instream channel. The load allocation for suspended sediment as measured at the USGS gage at Ferry Butte (13069500) is 72,074 tons/year (Table ES-2). As the receiving water of this reach is American Falls Reservoir, load allocations were established for both phosphorus and nitrogen. Annual load allocations at the USGS Ferry Butte gage are 167 tons of total phosphorus and 1,918 tons of total nitrogen. This stream segment should be scheduled for future BURP monitoring to determine support of beneficial uses.

Snake River – Ferry Butte to Bingham-Bonneville county line – This water quality limited segment is listed for flow alteration, DO, nutrients, and sediment (Table ES-1). As mentioned, no TMDLs were prepared for stream reaches affected by flow alteration. Data do not indicate that DO levels are violating water quality standards, thus no TMDL was written for dissolved oxygen. No data were reviewed to suggest sediment is

Table ES-2. Load and wasteload allocations for phosphorus, nitrogen, and sediment for American Falls Subbasin waterbodies and point sources.

Waterbody	Site	Total phosphorus (tons/year)				Total nitrogen (tons/year)				TIN ¹ (tons/year)		Nitrate+nitrite (tons/year)		Suspended sediment (tons/year)			
		Annual load		Annual wasteload		Annual load		Annual wasteload		Annual load		Annual wasteload		Annual load		Annual wasteload	
		Allo-cation	Reduc-tion	Allo-cation	Reduc-tion	Allo-cation	Reduc-tion	Allo-cation	Reduc-tion	Allo-cation	Reduc-tion	Allo-cation	Reduc-tion	Allo-cation	Reduc-tion	Allo-cation	Reduc-tion
303(d) listed waterbodies																	
Snake River	nr Blackfoot USGS gage ²	167	0			1,918	0							72,074	0		
	at Blackfoot USGS gage	146	0			1,649	0							34,619	0		
	nr Shelley USGS gage	171	0			2,066	0							34,573	0		
Bannock Creek		2.6	3.9			43	19							948	99		
Moonshine Creek														168	218		
Rattlesnake Creek														307	327		
West Fork Bannock Creek														55	0		
McTucker Creek		6.5	0.0			164	68							1,439	0.0		
Portneuf River ³	Tyhee USGS gage	22	365							348	796						
Non 303(d) listed waterbodies																	
Clear Creek		1.07	0.00			31.2	32.6										
Danielson Creek		1.92	0.00			47.1	6.7							627	0		
Hazard Creek (Little Hole Draw)		0.82	3.26			14.0	32.9							164	0		
Seagull Bay tributary		0.27	0.89			4.3	0.0										
Spring Creek		8.62	0.00			299	92										
Sunbeam Creek		0.22	0.85			3.7	0.6							261	153		
Cedar spillway		0.36	0.00			4.2	0.0										
Colburn wasteway		0.26	0.03			4.4	2.9										
Crystal springs		2.32	0.00			41.1	58.1										
Nash spill		0.009	0.00			0.1	0.0										
R spill		0.003	0.00			0.03	0.00										
Spring Hollow		0.26	0.48			4.4	47.4										
Sterling wasteway		0.27	0.17			4.6	4.5										
Point sources																	
Aberdeen WWTP				0.03	0.79			0.5	5.6							7.3	0.0
Blackfoot WWTP				9.46	0.00			55.9	0.0							72.5	0.0
Firth WWTP				0.49	0.00			3.0	0.0							8.0	0.0
Shelley WWTP				1.28	0.00			7.2	0.0							21.0	0.0
Crystal Springs Trout Farm				1.22	0.00			6.7	0.0							61.1	0.0
City of Blackfoot stormwater runoff				0.33	0.00							0.10	0			21.9	68.0

¹TIN=total inorganic nitrogen (nitrate+nitrite+ammonia)²this gage site is actually at Ferry Butte and Tilden Bridge³Portneuf River is not on the 303(d) list under American Falls Subbasin, but is on the 303(d) list under its own subbasin

This Page Intentionally Left Blank.

impairing beneficial uses in this reach; however, the effect of bedload and water column sediment in average to high water years is unknown. Until such data are collected, or BURP assessment indicates beneficial support, it is assumed that sediment is impairing beneficial uses in the reach. Beneficial uses possibly affected are coldwater aquatic life and salmonid spawning. Stormwater runoff from the City of Blackfoot and agriculture are sources of sediment. Additional sediment sources may include the livestock grazing and streambanks. The load allocations for suspended sediment as measured at the USGS gages at Blackfoot (13062500) and near Shelley (13060000) are 34,619 and 34,573 tons/year, respectively (Table ES-2). Nutrients do not appear to be impairing beneficial uses in Snake River, but as the river discharges to American Falls Reservoir, load allocations were established for both phosphorus and nitrogen. Wastewater treatment plants (WWTP) in Blackfoot, Firth, and Shelley, as well as City of Blackfoot stormwater runoff, contribute nutrients to Snake River in this reach. Other possible nutrient sources include agriculture and livestock. Annual load allocations at USGS gage sites at Blackfoot and near Shelley are 146 and 171 tons of total phosphorus and 1,649 and 2,066 tons of total nitrogen, respectively. This stream segment should be scheduled for future BURP monitoring to determine support of beneficial uses.

Bannock Creek – American Falls Reservoir to Reservation Boundary – This water quality limited segment is listed for bacteria, nutrients, and sediment (Table ES-1). Data were incomplete to confirm violations of water quality standards for *E. coli*; therefore, no TMDL was written for bacteria. It was recommended that DEQ and Shoshone-Bannock Tribes cooperate in a sampling effort to confirm bacteria standards violations. No data were reviewed as to support of beneficial uses in this water quality limited segment of Bannock Creek. The beneficial use most likely affected is coldwater aquatic life. Load allocations were established for both nutrients and sediment. Land management activities (e.g., agriculture and livestock grazing) are major sources of nutrients into mainstem Bannock Creek. Nutrient load allocations are 2.6 and 43 tons/year for total phosphorus and total nitrogen, respectively. Possible sources of sediment include agriculture, livestock grazing, and roads. Additional sediment sources may include the instream channel and streambanks. The Generalized Watershed Loading Functions (GWLf) model was used to establish a sediment load for Bannock Creek in comparison to streambank stability and water column sediment data from West Fork Bannock Creek, which served as a reference for Bannock Creek watershed streams. The annual load allocation for sediment is 948 tons (Table ES-2). This stream segment should be scheduled for future BURP monitoring to determine support of beneficial uses.

Bannock Creek – Reservation boundary to headwaters – This water quality limited segment is listed for bacteria, nutrients, and sediment (Table ES-1). Data were incomplete to confirm violations of water quality standards for *E. coli*; therefore, no TMDL was written for bacteria. It was recommended that DEQ and Shoshone-Bannock Tribes cooperate in a sampling effort to confirm bacteria standards violations. Assessment of BURP data indicates the stream is not supporting its beneficial uses. The primary beneficial use affected is coldwater aquatic life. Load allocations were not stratified based on water quality limited segment, i.e., only one overall load allocation

for each pollutant was recommended (see Bannock Creek – American Falls Reservoir to Reservation boundary above for nutrient and sediment load allocations).

Moonshine Creek – This tributary to Bannock Creek is listed on the 303(d) list for sediment (Table ES-1). No data were reviewed as to support of beneficial uses in Moonshine Creek. The beneficial use most likely affected is coldwater aquatic life. Possible sources of sediment include agriculture, livestock grazing, and roads. Additional sediment sources may include the instream channel and streambanks. The GWLF model was used to establish a sediment load for Moonshine Creek in comparison to streambank stability and water column sediment data from West Fork Bannock Creek, which served as a reference for Bannock Creek watershed streams. The annual load allocation for sediment is 168 tons (Table ES-2). This stream should be scheduled for future BURP monitoring to determine support of beneficial uses.

Rattlesnake Creek – This tributary to Bannock Creek is listed on the 303(d) list for sediment (Table ES-1). Assessment of BURP data indicates the stream is not supporting its beneficial uses. The primary beneficial use affected is coldwater aquatic life. Possible sources of sediment include agriculture, livestock grazing, and roads. Additional sediment sources may include the instream channel and streambanks. The GWLF model was used to establish a sediment load for Rattlesnake Creek in comparison to streambank stability and water column sediment data from West Fork Bannock Creek, which served as a reference for Bannock Creek watershed streams. The annual load allocation for sediment is 307 tons (Table ES-2).

West Fork Bannock Creek – This tributary to Bannock Creek is listed on the 303(d) list for sediment (Table ES-1). No data were reviewed as to support of beneficial uses in West Fork. This tributary presently displays significant water quality and habitat improvement. These improvements are directly related to the management measures (fencing of riparian corridor) that have been implemented in the subwatershed. This improvement in water and habitat quality is deemed significant enough to consider West Fork a viable target in the GWLF model for gaging the level of improvement necessary in other 303(d) listed waterbodies within Bannock Creek watershed. The annual load allocation for sediment is 55 tons (Table ES-2). This stream should be scheduled for future BURP monitoring to determine support of beneficial uses.

Knox Creek – This tributary to Bannock Creek is listed on the 303(d) list for unknown pollutants (Table ES-1). Assessment of BURP data indicates the stream is not supporting its beneficial uses. The primary beneficial use affected is coldwater aquatic life. Possible pollutant sources are agriculture and livestock grazing. Additional sediment sources may include the instream channel, streambanks, and roads. No data were available to indicate nutrients are affecting beneficial uses, although the overall nutrient load allocation for Bannock Creek would encompass Knox Creek. An individual load allocation for sediment was not made for Knox Creek, but is part of the overall sediment load allocation for Bannock Creek (see Bannock Creek – American Falls Reservoir to Reservation boundary). More data are needed to determine what is causing impairment of beneficial uses in Knox Creek.

McTucker Creek – This stream is listed on the 303(d) list for sediment (Table ES-1). Assessment of BURP data indicates the stream is not supporting its beneficial uses. Beneficial uses affected are coldwater aquatic life and salmonid spawning. Possible sources of sediment are historic activities, livestock grazing, instream channel, and streambanks. The annual load allocation for sediment is 1,439 tons (Table ES-2). As this stream contributes to nutrients in American Falls Reservoir, load allocations were recommended for phosphorus and nitrogen. Total phosphorus and total nitrogen load allocations are 6.5 and 164 tons/year, respectively.

Danielson Creek – This stream is not on the 303(d) list, but assessment of BURP data indicates the stream is not supporting its beneficial uses. The primary beneficial uses affected are coldwater aquatic life and salmonid spawning. It is unknown what is causing impairment of beneficial uses in Danielson Creek so load allocations are recommended for both nutrients and sediment. In addition, Danielson Creek is a source of nutrients into American Falls Reservoir. Possible pollutant sources are agriculture and livestock grazing. Additional sediment sources may include the instream channel and streambanks. Total phosphorus and total nitrogen load allocations are 1.92 and 47.1 tons/year, respectively (Table ES-2). The annual load allocation for sediment is 627 tons.

Hazard Creek/Little Hole Draw – This stream is not on the 303(d) list, but assessment of BURP data indicates the stream is not supporting its beneficial uses. The primary beneficial uses affected are coldwater aquatic life and salmonid spawning. It is unknown what is causing impairment of beneficial uses in Hazard Creek/Little Hole Draw so load allocations are recommended for both nutrients and sediment. In addition, Hazard Creek/Little Hole Draw is a source of nutrients into American Falls Reservoir. Aberdeen WWTP contributes nutrients and some sediment to the creek. Other possible pollutant sources are agriculture, livestock grazing, and urban activities. Additional sediment sources may include the instream channel and streambanks. Total phosphorus and total nitrogen load allocations are 0.82 and 14.0 tons/year, respectively (Table ES-2). The annual load allocation for sediment is 164 tons.

Sunbeam Creek – This stream is not on the 303(d) list, but assessment of BURP data indicates the stream is not supporting its beneficial uses. The primary beneficial use affected is coldwater aquatic life. It is unknown what is causing impairment of beneficial uses in Sunbeam Creek so load allocations are recommended for both nutrients and sediment. In addition, Sunbeam Creek is a source of nutrients into American Falls Reservoir. Possible pollutant sources are agriculture and livestock grazing. Additional sediment sources may include the instream channel and streambanks. Total phosphorus and total nitrogen load allocations are 0.22 and 3.7 tons/year, respectively (Table ES-2). The annual load allocation for sediment is 261 tons.

Clear Creek – This stream is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 1.07 and 31.2 tons/year, respectively (Table ES-2). This stream should be scheduled for future BURP monitoring to determine support of beneficial uses.

Seagull Bay tributary – This stream is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.27 and 4.3 tons/year, respectively (Table ES-2). This stream should be scheduled for future BURP monitoring to determine support of beneficial uses.

Spring Creek – This stream is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 8.62 and 299 tons/year, respectively (Table ES-2). This stream should be scheduled for future BURP monitoring to determine support of beneficial uses.

Cedar spillway – This agricultural return drain is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.36 and 4.2 tons/year, respectively (Table ES-2).

Colburn wasteway – This agricultural return drain is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.26 and 4.4 tons/year, respectively (Table ES-2).

Crystal springs – This waterbody is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 2.32 and 41.1 tons/year, respectively (Table ES-2).

Nash spill – This agricultural return drain is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.009 and 0.1 tons/year, respectively (Table ES-2).

R spill – This agricultural return drain is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.003 and 0.03 tons/year, respectively (Table ES-2).

Spring Hollow – This waterbody is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.26 and 4.4 tons/year, respectively (Table ES-2).

Sterling wasteway – This agricultural return drain is not on the 303(d) list, but does contribute to nutrient loads in American Falls Reservoir. Total phosphorus and total nitrogen load allocations are 0.27 and 4.6 tons/year, respectively (Table ES-2).

Portneuf River – This stream is on the 303(d) list and a TMDL has already been approved for the Portneuf River Subbasin. The river contributes to nutrient loads in American Falls Reservoir. The total phosphorus load allocation is 22 tons/year (Table ES-2). For consistency with the Portneuf River Subbasin TMDL, a load allocation for total inorganic nitrogen was set at 348 tons/year.

Aberdeen wastewater treatment plant – This point source contributes nutrients and some sediment to Hazard Creek/Little Hole Draw, and ultimately to American Falls Reservoir. Nutrient wasteload allocations are 0.03 and 0.5 tons/year for total phosphorus and total nitrogen, respectively (Table ES-2). The annual wasteload

allocation for sediment is 7.3 tons. Nutrient wasteload allocations require a reduction of current estimated wasteloads while the sediment wasteload allocation does not.

Blackfoot wastewater treatment plant – This point source contributes nutrients and some sediment to Snake River, and ultimately to American Falls Reservoir. Nutrient wasteload allocations are 9.46 and 55.9 tons/year for total phosphorus and total nitrogen, respectively (Table ES-2). The annual wasteload allocation for sediment is 72.5 tons. Neither nutrient nor sediment wasteload allocations require a reduction of current estimated wasteloads.

Firth wastewater treatment plant – This point source contributes nutrients and some sediment to Snake River, and ultimately to American Falls Reservoir. Nutrient wasteload allocations are 0.49 and 3.0 tons/year for total phosphorus and total nitrogen, respectively (Table ES-2). The annual wasteload allocation for sediment is 8.0 tons. Neither nutrient nor sediment wasteload allocations require a reduction of current estimated wasteloads.

Shelley wastewater treatment plant – This point source contributes nutrients and some sediment to Snake River, and ultimately to American Falls Reservoir. Nutrient wasteload allocations are 1.28 and 7.2 tons/year for total phosphorus and total nitrogen, respectively (Table ES-2). The annual wasteload allocation for sediment is 21.0 tons. Neither nutrient nor sediment wasteload allocations require a reduction of current estimated wasteloads.

Crystal Springs Trout Farm – This point source contributes nutrients and some sediment that ultimately reach American Falls Reservoir. Nutrient wasteload allocations are 1.22 and 6.7 tons/year for total phosphorus and total nitrogen, respectively (Table ES-2). The annual wasteload allocation for sediment is 61.1 tons. Neither nutrient nor sediment wasteload allocations require a reduction of current estimated wasteloads.

City of Blackfoot stormwater runoff – This point source contributes nutrients and sediment to Snake River, and ultimately to American Falls Reservoir. The total phosphorus load allocation is 0.33 tons/year (Table ES-2). As data for total nitrogen were not available, but nitrate+nitrite data were, the wasteload allocation for nitrogen is set at 0.10 tons/year of nitrate+nitrite. The annual wasteload allocation for sediment is 21.9 tons. Nutrient wasteload allocations do not require a reduction of current estimated wasteloads while the sediment wasteload allocation does.

Waterbodies Recommended for Delisting

Information used to prepare this document justifies the delisting of pollutants for several waterbodies in the subbasin. No data were reviewed to indicate sediment was affecting beneficial uses in American Falls Reservoir. Monitoring of dissolved oxygen in Snake River showed no violations of water quality standards. Levels of nutrients observed in Snake River were low compared to target concentrations used to establish load allocations. Thus, it is

recommended that for future 303(d) lists, American Falls Reservoir be delisted for sediment, and Snake River be delisted for dissolved oxygen and nutrients.

Possible Additions to 303(d) List

Data examined during preparation of the TMDL imply possible impairment of beneficial uses due to pollutants additional to those on the 303(d) list. Violations of water quality standards for temperature in both American Falls Reservoir and Snake River were documented. Both waterbodies should have temperature included on future 303(d) lists.

Assessment of BURP data indicated several other non 303(d)-listed streams not supporting their beneficial uses. The following did not support coldwater aquatic life and/or salmonid spawning in at least a portion of the watershed and should be considered for inclusion on future 303(d) lists: Danielson Creek, Hazard Creek (Little Hole Draw), and Sunbeam Creek.

Data Gaps

Several aspects of the TMDL would be improved with additional data. These data would serve to better refine links between pollutants and beneficial uses, natural background levels, more appropriate targets, and better estimates of load allocations. The following is by no means an exhaustive list of all data needs in the American Falls Subbasin:

- natural background levels of nutrients and sediment,
- nutrient and sediment data from average and above average water years,
- refinement of nutrient levels necessary to support beneficial uses,
- contribution of springs to reservoir nutrient loads,
- bathymetric data from American Falls Reservoir,
- better estimates of internal phosphorus loading in American Falls Reservoir,
- increased sampling of the reservoir to include more sites over a longer period (e.g., April through September),
- sediment bedload data from average to above average water years in subbasin streams, especially Snake River,
- complete survey of streambank stability in Bannock Creek watershed streams,
- additional water quality information from tributaries on the Fort Hall Indian Reservation,
- regular stream flow information throughout the year for tributaries,
- bacteria sampling in Bannock Creek,
- ambient monitoring above and below wastewater treatment plant effluent discharges, and
- identification of pollutant sources in the subbasin.

Implementation Strategies

Any implementation plan will concentrate on reducing nutrients and sediment. For point sources such as wastewater treatment plants, it is expected that future NPDES permits will include recommended limitations on nutrients. Reduction in pollutant loadings for nonpoint

sources will most likely require a mix of policy changes, program initiatives, and implementation of Best Management Practices.

Certain state agencies have been designated to work with particular industries that have the potential for contributing nonpoint source pollutants. For example, the Idaho Soil Conservation Commission has the responsibility to work with agriculture and the livestock industry on development of their implementation plan to meet recommendations set out in the American Falls Subbasin TMDL.

No timelines are presented as to when water quality will improve to the point of supporting beneficial uses. Such dates are dependent on a myriad of factors such as financial support, landowner cooperation, and geological processes (e.g., sufficient stream flows to mobilize sediment and move it out of the system). The hope would be to see some significant changes toward meeting the goals of the TMDL within ten years.

This Page Intentionally Left Blank.